Information Overload: A Collaborative Dance Performance

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Abstract

Information Overload: A Collaborative Dance Performance
Lauren Elizabeth Mandilian
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The artistry of dance spans a multitude of professional fields encompassing an array of technologies including projection, video, audio, and interactive media. This thesis explores opportunities in which digital media can be incorporated into a modern dance performance. The piece, *Information Overload*, an original dance piece produced as part of this thesis project, examines how we relate to technology. Furthermore, the piece serves as a vehicle to explore various ways in which technology can add to the overall dance performance. This thesis project brings together and draws expertise and knowledge from several programs including Performing Arts, Digital Media, Electrical and Computer Engineering, and Music Industry.

CHAPTER 1: INTRODUCTION

Many technological advances such as the cell phone, text messages and email are often intended to make it easier for people to communicate with one another. A problem arises when the use of these devices becomes overwhelming. Numerous times each day, the telephone rings, e-mails are sent and received, the Internet is traversed, and websites are explored. Many times all of these communication venues are occurring simultaneously. Despite the feeling of being overwhelmed, newer and faster communication technologies are introduced by manufacturers and embraced by consumers.

Some choreographers are exploring ways to incorporate dance and digital technology. They experiment with the use of projection, video, audio, and interactive media. Because of the wide range of expertise needed to implement these technologies, many pieces are collaborations between different professionals. One issue choreographers are facing is whether the digital technology used in a piece is showcasing the technology or creating a cohesive piece.

This thesis work includes research and documentation on how digital media can be used as a part of dance. Research methods include a literature review, performance review, theory, and interactive art. This research provides a background of what has been done in these fields and directly influences a performance piece, named *Information Overload*. A production journal is kept to document the process and highlight learning during the creation of the piece. The performance is a modern dance piece about how we as an American culture relate to the overwhelming nature of technology, yet still demand more.

CHAPTER 2: LITERATURE AND PERFORMANCE REVIEW

Information Overload draws attention to the contradiction that while digital technologies hold the promise of making communication easier, and life itself more pleasant, all too often, they drive us into deeper personal isolation, restricting communication and decreasing the quality of life. This piece is inspired by performances, texts, and interactive art. The performances reviewed provide a background and visceral experience of what has been done in these fields and with digital media. The texts examine the relationships between society and technology and inspired the idea of dancers interacting with digital media as part of the interactive art.

2.1: Performances

Electrical technology and dance dates back to the late 19th century with Loie Fuller who explored the use of light and fabric [Mazo77]. By 1887, she had established herself as a professional actress in Europe. She was not trained as a dancer, but when provided with an invitation by a director, she launched her career. "When you are starving, you sometimes forget to be strictly truthful," said Fuller recounting the moment [Mazo77]. Uncertain of what to do, Fuller found some cheesecloth backstage and waved her arms to make it twist and sway. This led to other discoveries; she experimented with different color lights to illuminate the fabrics as she moved; in fact, her crew consisted of fifty electricians. Fuller learned to rely on her skirt instead of her body transforming the fabric into natural objects and abstract patterns.

Figure 2.1A *Tensile Involvement*

Realizing that many components help to construct a well-defined dance piece, Alwin Nikolais an innovative choreographer began to incorporate color, costume, lighting, and set in addition to movement into his productions. Nikolais was born on November 25, 1910 in Southington, Connecticut [Nikolais05]. In 1934 he attended a concert by Mary Wigman, a German expressionist dancer/choreographer. The concert had such a great appeal to Nikolais that he became a student of the Wigman School. Following his education, he established his own dance company in 1948. Nikolais created new devices to light and isolate the dancer. In addition to using projectors to add color to the stage, he experimented with electronic and synthesizer equipment to create his own sound scores. In 1953, Nikolais created *Tensile Involvement*, a representative example of his exploration of elasticity with the set [Repertory06]. It consisted of ten dancers who performed with eight long pieces of elastic (see Figure 2.1A). Influenced by fellow choreographer, Merce Cunningham, Nikolais created the music and used projection to add texture to the performance. Research into these specific pieces by Nikolais and Fuller informed *Information Overload* in which projected animation on elastic fabric played a major part.

Merce Cunningham was born on April 16, 1919 in Centalia, Washington [Vaughan97]. Between 1939-1945 he was a soloist in the Martha Graham Dance Company. In 1953, he established his dance company. During the 1950s, Cunningham worked with composer John Cage to create electronic sound scores for his pieces. Both Cunningham and Cage used chance procedures by tossing a coin or *I Ching* to structure their compositions as well as the performances. Cunningham believes that dance, music, and set exist independently of one another. In this way, the performers do not hear the music or see the set until the piece is performed. According to Robert Greskovic of "Fifty Contemporary Choreographers," Cunningham uses the "oft-noted independence of traditionally interdependent theatrical elements" [Bremser06].

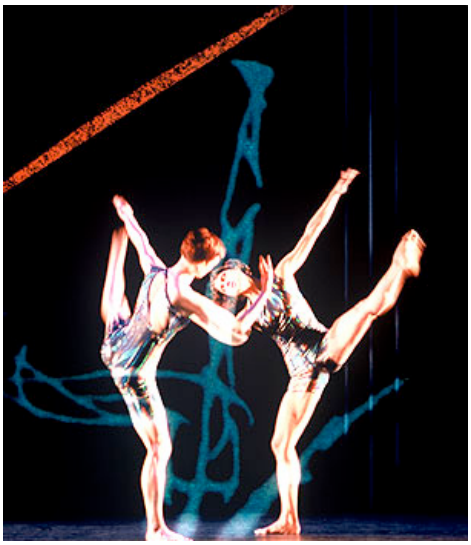

Figure 2.1B *Biped*

In 1999 Cunningham collaborated with Paul Kaiser of Riverbed Studio, Cunningham to create *Biped* [Digital00]. The piece used motion capture devices to record the dancers' movements; the data collected was displayed as abstract moving line art. During the performance, the imagery was projected onto a transparent scrim mounted to the proscenium. This made the images appear to be floating in front of the live dancers (see Figure 2.1B). It was because of these larger then life projections, an idea, which appears throughout *Information Overload*, that this piece was researched.

In the 1960's, a collaborative of musicians, John Cage and Robert Dunn, and choreographers, Meredith Monk and Yvonne Rainer, formed a group known as Judson Church [Mazo77]. Judson Church was known for their work in Post-modern dance. This period consisted of pedestrian movement, the use of everyday props, and settings outside the traditional stage. In 1966, Judson Church produced an event titled *9 Evenings: Theatre and Engineering* [Oppenheimer06]. This event featured the collaboration of dancers and engineers from Bell Telephone Laboratories in a series of technology-based performances. The engineers designed new uses for technologies such as infrared video and wireless radio transmitters to

name a few. Oppenheimer referred to the event as the "collaborative process…between artists and engineers who came from different worlds" [Oppenheimer06].

Another milestone in the marriage between dance and digital technology occurred during October 1988 and March 1989. The Three Dimensional Interactive Space (3DIS) was created [Burt90]. This computer vision system made decisions based on the information it received. A camera was used as the input device and a musical synthesizer produced the output. The computer calculated thirty times per second the average brightness of an area. In other words, if a pale person put his hand on a black vase, it would register a big change in light level. The amount of change in light level would determine the type of sound produced. As a result, the dancers were responsible for the sound; in essence, they were the musicians.

In 1999 Troika Ranch, a company formed in 1994, performed *In Plane* at the International Dance and Technology Conference at Arizona State University [Jackson99]. This group placed a great deal of emphasis on the interactivity between dance and technology. For example, if a dancer moves stage right the sound may become quieter. If the dancer moves stage left, the music may become louder. Troika Ranch strives for the same sense of liveliness in their media as the performers themselves. This is especially true in *In Plane*, which was a collaboration of sound, costume, and dance. One of the founders, Mark Conigillio developed the MIDIDancer, a system that attaches to the body and makes different noises based on the dancer's movement. To further enhance the relationship between the dancer and technology, MIDIDancer was used in the piece. Incorporating immense visuals, *16 [R]evolution* was created in 2006 [Troika06] and consisted of 3D images that warped and morphed in direct response to the dancers' movement. In one section two performers were lit only by the projection of a "digital rib cage" (see Figure 2.1C). The "ribs" moved in direct response to the dancers' movement creating a trio of dancers and media. The technology used was a real-time motion capture system and a software program developed by Conigilio called Isadora. In the real-time motion capture system, an imaginary "skeleton" was imposed

Figure 2.1C *16 [R]evolution*

on the outline of the dancers body and seen by a video camera (see Figure 2.1D). The points of the "skeleton" were sent to Isadora, which used the data to manipulate the media.

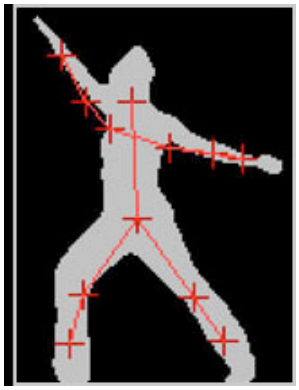

Figure 2.1D "Skeleton" used to track dancer

In 1993, Douglas Rosenberg used video in his piece *Singing Myself a Lullaby* [Rosenberg06]. The dancer, an AIDS patient, performed the dance a number of times for three years. At each show, the piece was performed with video images highlighting what was happening on the inside of the dancer's body as well as images of how he looked in previous performances. Each time the dance was performed the dancer was weaker and weaker. The images projected showed the disease progressing inside of the dancer's body. This progression made the piece different every time it was performed. It also served to document the final three years of the dancer's life. Another performance to combine dance and video, *Second Nature*, was performed in 2002 by the Anita Cheng Dance Repertory [Cheng06]. This piece used real-time video as well as time delay allowing the dancer to perform with her own image which was produced a few seconds prior.

Digital technology has also been used to facilitate the interaction between the dancer and audience. In 1996, Marcel.li Antunez Roca created *Epizoo* [Kac98]. During the performance, the dancer wore a special suit. A person at a computer controlled the suit that controlled the dancer's movements. There was also a projection screen above the dancer as he performed. During the performance, audience members could use the computer to manipulate what the dancer looked like on the projection screen; for example, they could stretch parts of his face such as the ears, nose, or mouth.

Universities are collaborating with dancers to bridge the gap between traditional dance and digital technology. In 2004 Purdue University created *100d11A0N1C00E1*, a collaborative performance of dance and computer graphics (CG) [Meador04]. The piece consisted of a 3D virtual character that was controlled by a motion-captured dancer in another room. The character was able to move across the entire stage by use of multiple video screens. Live dancers were also included in the piece to show an interaction between humans and technology (see Figure 2.1E). Some challenges of this project were that the dancers had to learn how to work in a more linear fashion. Storyboards had to be created for the movement.

Choreography was limited because it had to be determined earlier in the process; in addition, the motion capture suit made some movement constraining. The CG artists also faced the challenge of having to develop a flexible character that could be updated quickly. One positive of the project was that the virtual character could occupy the vertical space of the stage, which is not always used. A dancer is only so tall and can only go as high as a physical set can lift her; on the other hand, the digital character was not limited by these physical restraints. Another innovation was that multiple performance frames were created for interacting with the digital content. Performance frames refer to the traditional stage dancers, silhouetted dancers, the mocap dancer, and the virtual dancer that were used in the piece.

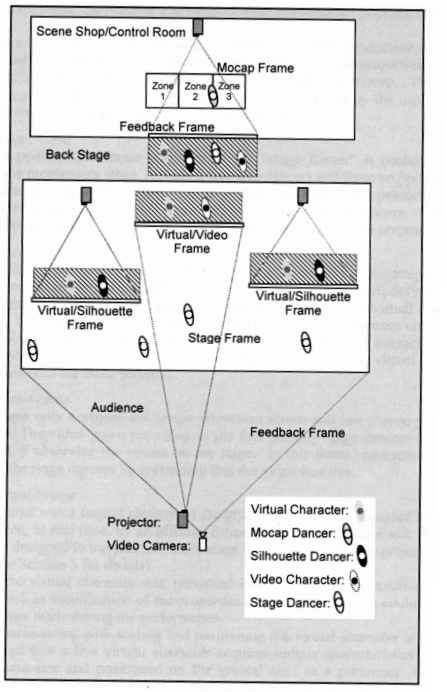

Figure 2.1E *100d11A0N1C00E1*

Timothy J. Rogers, one of the creators of *100d11A0N1C00E1*, suggested supplying visual feedback to the live dancers to avoid disorientation [Rogers07]. One of the challenges of incorporating live dancers with their digital counterparts is that the digital dancer cannot observe the live dancers on stage. This makes it difficult for all the dancers to remain synchronized with the choreography. For *100d11A0N1C00E1*, a screen was set up for the motion-captured dancer so she could see her digital self as well as the live dancers on stage.

Integrating dance and digital technology continues to be a subject of interest in many universities. Dancer and scientist, Jodi James who teaches at Arizona State University's Arts, Media and Engineering program encourages interdisciplinary study, especially in the area of dance [Tu06]. In 2005 James and ASU created *Lucidity*, a movement-based interactive dance performance [James05]. The piece was based on the correlation of 3 dancers in time and space to control the visuals and sound. For example, in the first section the sound was determined by the proximity of the three dancers to one another; in the third section, a graphical history of the dance was projected above the dancers in real-time. The movement for the piece was structured improvisation, meaning a framework for the choreography was established, but the dancers

also had opportunities to invent their own movement so they could contribute their own personality to the work. The piece was accomplished using a motion capture system. Each dancer wore retro-reflective markers as a part of their costume. Sixteen cameras were used in total; a light emitter ring set to a specific light frequency surrounded each camera. When two or more cameras viewed the same marker, the computer system could place a marker at its 3D coordinate.

There were many obstacles the team had to overcome with the system. First, all the cameras had to be hidden from the audience. To solve this, the cameras were mounted in the grid of the stage. Also in consideration, the cameras needed to be placed strategically so that the lighting or reflection off the floor did not blow out the image of the dancer. Second, the movement was restricted because complex movement made the system unreliable. Third, in order for the system to run fast enough, data could only be taken from the dancers' upper body. Because of this, it was decided that the costume would consist of a form fitting shirt and flowing skirt. Lastly, a custom-built communication system had to be developed to take the data from the dancers and manipulate the sound and images. This innovative performance was not dictated by the music and visuals; instead the dance influenced the music and visuals in real-time.

In the inter-media performance group, Palindrome's *Perceivable Bodies*, performed at the SIGGRAPH 2006 conference, the dancer interacted with projected text in real time [Palindrome06]. As the dancer moved one way, the text also moved in the same direction. For Seo and Kim's *spatial ascillator*, the dancer's movement controlled the musical composition (notes, panning, etc.) [Seo06]. THEATER DER KLANGE also presented a video of a few of their pieces [Theater06]. The most impressionable piece to this project, *Schattenintermezzo*, experimented with dancer's shadows. In this extraordinary piece, three shadows were projected during a segment of the performance. The first was the dancer's actual shadow in its real life location. The second was the dancer's real-time shadow projected on another section of the stage. The third was a delayed shadow projected on yet another section of the stage. The dancer and her shadows all interacted together to create a quasi-group composition instead of the traditional solo. This solo became more powerful because it placed the dancer with three other digital representations of her. (see Figure 2.1F)

Figure 2.1F THEATER DER KLANGE's HOEReographien: SchattenIntermezzo

During the month of October 2006, New Paradise Laboratories, a professional non-profit theater company, was in residence at Drexel University. The company created a piece that integrated digital media with a live performance. During the performance, the audience was seated on stage and watched the performers on an elevated platform (representing a boxing ring). A video camera and a projection screen were placed at each side of the platform (see Figure 2.1G). The purpose of the cameras and projection screens were to allow the audience to look at all four screens and see a different perspective of the stage creating a "theater in the round" experience. Digital media was used to create a more dynamic performance for the audience by offering different perspectives of the show simultaneously.

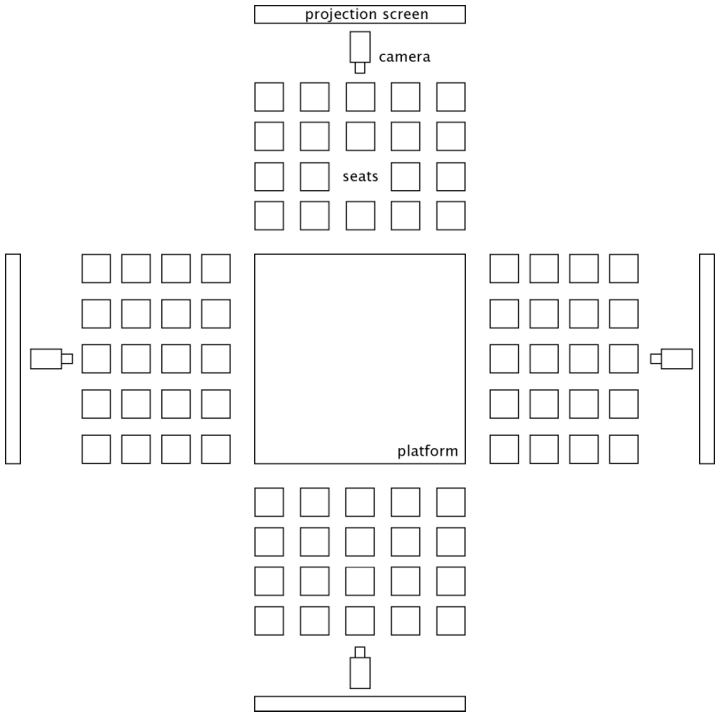

Figure 2.1G New Paradise Laboratories stage setup for *Batch*

The Painted Bride Art Center played host to Marianela Boán and her piece *False Testimony*. Boán, a leader of the Cuban and Hispanic-American dance movement, merges all of the arts to "produce an original, expressive form" [Boán06]. *False Testimony* integrated real-time video projection with a set. Two dancers performed behind two wooden shipping crates. Their movement was recorded by a video camera and projected onto the front of the crates. To the audience, it appeared as if they could see through the crates to the dancers. The piece also featured an interaction between a live dancer and her projected digital partner. One dancer would perform in front of the crate while the other dancer performed behind. The rear dancer would be projected and it appeared as if the two were performing together. This performance tightly integrated video, set, and movement. The use of digital media shared equivalent importance as the live dancers.

An important company to the Philadelphia area, Group Motion, evolved from the Mary Wigman School of Dance [Group07]. Group Motion became successful rather quickly after making an appearance at Judson Church. Manfred Fischbeck, the artistic and executive director of Group Motion is known for his work in dance, multimedia, and interactive technology. Fischbeck is also known for his interdisciplinary

collaborations with artists worldwide in the fields of set and lighting design, sculpture and painting, poetry, media, and new technologies. Group Motion's dances "are often layered with distinctive combinations of video, text, soundscape, visual art, and original music" resulting in "a richly textured, image-filled evocation of the theme" [Group07]. One of the members of Group Motion, Olive Prince, created *Spare Change*, which explored poverty through the use of dance and video. The piece began with no dancers present on stage and a video of highly textured images of run down neighborhoods and the people that live there. The video was projected high above the dance floor and when the dancers emerged on stage, it played above the dancers.

Dance and digital technology has been explored in many ways and has come to encompass projection, video, audio, and interactive media. Many of these pieces were collaborations between different professionals; Cunningham's *Biped* collaborated with Riverbed Studio, Troika Ranch is made up of a computer expert and choreographer, and universities have teamed up different departments to create pieces. The pieces that have been reviewed showcase ways that new technologies can be applied to a choreographer's concept.

The aforementioned pieces pose the question what is most important, the technology or the dance? While pieces such as *Perceivable Bodies*, *spatial ascillator*, and *Schattenintermezzo* provided a visceral enjoyment, questions were raised as to whether there was a true message in the piece or were Palindrome, Seo and Kim, and THEATER DER KLANGE just creating a piece that showcased the technology. It is important for a choreographer to consider when technology is being used to further the concepts put forward in the dance, or when it becomes a goal in and of itself.

Troika Ranch's Conigilio feels that they don't "use technology just because [they] can; it depends on what the piece is about and how the medium will enable [them] and the audience to see movement in different ways" [Johnson05]. New Paradise Laboratories used technology to integrate the audience more with the performance, while Marianela Boán used technology to merely create a cohesive work. Like Boán, the idea of this thesis is to create a cohesive piece that does not only showcase technology. The incorporation of digital media into *Information Overload* adds another layer to the piece as it becomes more evident that the piece is about how American culture relates to technology.

2.2: Integrating Technology with Dance

In his article for Dance Research Journal, "Dance and Technology: A Pas de Deux for Post-humans," contact improvisation artist Kent De Spain -discusses how dance and technology are coming together and changing the face of dance as we know it [Dance00]. The article focuses on how dance has moved into an era where adding technology to a piece poses new questions. De Spain considers dance to be the most "human" of the arts simply because it is expressed with the human body. He poses the question, does adding technology to a piece, make dance as an art form less human? De Spain argues that even though the technology isn't human, it is still moving. He adds, isn't that dancing? He also states that computers aren't the first time that dance and technology have been used together. He argues that photography, film, and video were used to document a dance. He goes on to say that future technologies such as motion capture will be used to accurately record a dance as well as allow us to view it from any angle.

ASU faculty member John Mitchell has a similar feeling towards dance and technology. He states, "As society changes, it reframes dance. Today, dance is framed by the technology that surrounds us" [Wolfram03]. Joe Koykkar of UW goes on to say, "Technology allows people to experience the arts in ways that they couldn't twenty years ago" [Wolfram03]. Because of the emphasis technology is playing on dance, many scholars believe that choreographers should have technical skills in computers as well as dance. Dr. Keitha Donnelly Manning of TCU has developed a studio that includes computers so choreographers can go back and forth between the floor and the software. Studio time is limited and expensive; the more you can do on a computer beforehand the better.

Associate Professor of Dance at the University of California, Dr. Lisa Naugle feels that technology can be just as expressive as live dancers [Naugel06]. In 2002 she created *The AVA Project*, which explored the relationship between humanity, technology, and creativity. AVA was a motion captured animated figure. It was projected onto different sculptural objects on stage and made a virtual dancing partner for the live dancer. Naugel feels that although adding technology to dance is a sign of change "the scope of the dance is not narrowing towards digital, rather it is expanding" [Dils00].

2.3: Texts Related to Technology and Society

Information Overload examines how we relate to technology. It questions, "*Who is in control of our technology?"* and asks, *"Do we control technology or does technology control us?"* The thrust of the investigation is based on two books, which address these themes: "Why Things Bite Back" by Edward Tenner [Tenner96] and "Techgnosis" by Erik Davis [Davis 98].

Tenner discussed the "revenge effects" of technology. Basically, Tenner states that technology was developed to help solve a problem. Unfortunately in the interim it often creates new problems at the same time. Through deep analysis of the book, one might conclude that revenge effects of technology would have a negative impact on society. However, Tenner surmised that problems caused by technology cause mankind to become more aware of the tribulations of technology and through this awareness develop solutions. The Titanic would be a classic example of this theory. When this "unsinkable" ship lay at the bottom of the ocean, it caused mankind to reevaluate the entire premise on which this ship was built. With each solution, our knowledge base increases and our problem solving skills are refined. If these problems never occurred, we would never have the opportunity to explore the impact on the populace. Unfortunately with each solution, a new set of problems arises and a catch-twenty-two formulates.

Davis's book, "Techgnosis", focused on society's mental addiction to technology. His belief is technology consumes our lives. He feels that people are so caught up in technology they don't even realize its demand on their lives. He compared technology to an addictive drug. Despite the fact that people are overwhelmed by the time constraints technology places on their lives, they continue to seek better, faster, and easier ways to communicate. For example, people constantly complain about the overabundance of e-mails received each day. Yet, the demand for increased bandwidth to provide richer content and consequently more e-mails increases daily.

Tenner and Davis's views raise several points. Tenner's view about revenge effects can be applied to personal face-to-face communication. We often choose to communicate to someone through e-mail or while walking to work with a cell phone because we find it more efficient then conversing with another person face to face. We have created excellent technologies intended to enhance communication, but often these very technologies tend to distance us from personal interaction. This is a classic example of revenge effect. A similar comparison can be made to Davis's viewpoint. Society becomes so wrapped up

in technology we begin to distance ourselves from one another. Technology controls us and takes over our lives as if we were addicted to a drug.

As a response to these texts, *Information Overload* includes dancers interact with technological devices and seem to ignore each other. Throughout the performance, disassociation grows deeper as the appetite for technology increases. By the conclusion it is clear technology has a firm grasp on the lifeline of the dancers and their desire for more technology grows out of control.

2.4: Interactive Art

Camille Utterback created *Text Rain*, an "interface of video camera and tracking software" [Utterback 04]. (see Figure 2.4A) The audience sees a mirrored image of themselves and letters falling like rain. The audience can catch, lift, and allow the letters to fall. It is possible for the audience to catch a word or phrase- there is no wrong way to interact with this piece. This fascinating technological application by Utterback has been incorporated in *Information Overload*. During the opening scene of the performance, dancers interact with falling text. This special effect illustrates mankind and technology working concurrently.

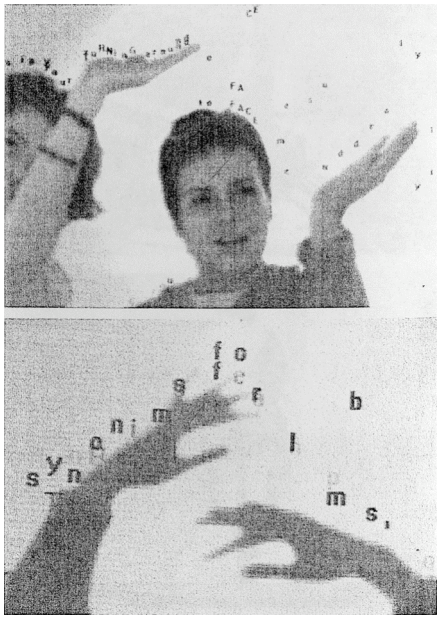

Figure 2.4A *Text Rain*

The Gertrude Stein Repertory Theatre (GSRT) has projected digital images onto choreographed performers [Faver 01]. (see Figure 2.4B) The performers' costumes were specially designed to provide larger display surfaces for projection. This revelation allowed the integration of projected images to become a part of the choreography. Based on the success of this technique, it was determined that *Information Overload* would benefit from an animation that is projected onto dancers holding fabric because it creates an interesting juxtaposition between the two-dimensional images and three-dimensional organic forms.

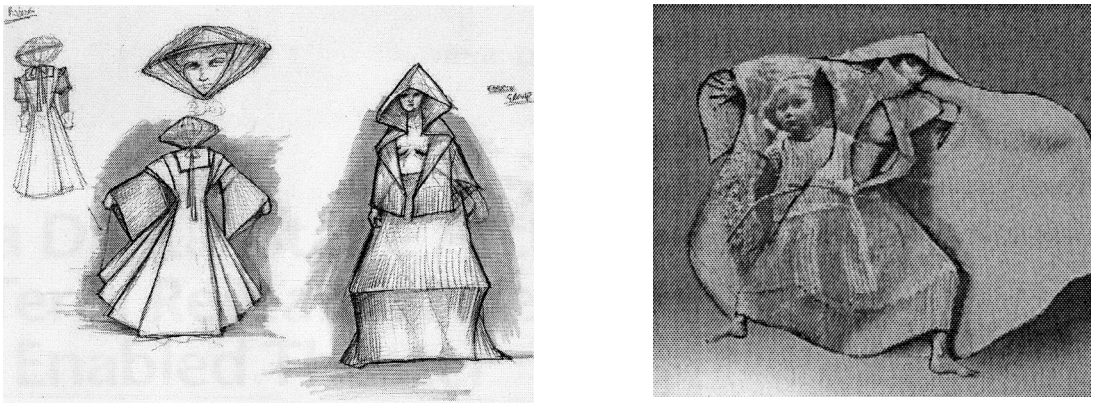

Figure 2.4B Gertrude Stein Repertory Theater

CHAPTER 3: DANCE DESCRIPTION AND RATIONALE

The piece begins with a projection of rolling clouds, which represent all that is nature. The clouds transition to rain clouds, and it begins to rain letters much like Text Rain by Camille Utterback. A dancer emerges from the wings with an umbrella. The projected letters bounce like raindrops off her umbrella. A new silhouetted dancer is projected on the center of the screen. This new dancer appears small in the distance. The dancer grows larger and larger as she walks towards the audience. The two dancers meet and turn away from each other. As they turn away, it appears as if they are multiplying because two more dancers morph out of their silhouettes. Simultaneously, the four dancers perform a choreographed dance piece. At the conclusion of the choreography, the two dancers that morphed out from the silhouettes return back to the silhouettes from which they came. Finally, the two remaining dancers exit the stage into the wings. THEATER DER KLANGE experimented with the idea of incorporating a dancer's shadow into a piece. The idea of using shadows was awe-inspiring and led to the vision of projecting the dancers in silhouette.

Figure 3A Storyboards for *Information Overload*

As the choreography is progressing, letters are replaced by individual words.

Immediately following the dancers exodus from the stage, the words are replaced by a quote taken from "Techgnosis" by Erik Davis:

> "Technology is a trickster
> The trickster shows how intelligence fares in an unpredictable & chaotic world;
> he beckons us through the open doors of innovation & traps us in the prison of unintended consequences"

The quote breaks up and the letters form the word "TECHNOLOGY". The projected word "TECHNOLOGY" increases to create a bright metropolis and is then projected onto the Broadway flats, flown onto stage to enhance the three dimensionality of the projected cityscape that has grown from the word technology. The ringing of a cell phone reverberates throughout the theater. The single cell phone sound grows to be a musical composition of vast varieties of technological sounds such as fax machines and computers. The dancers emerge from the wings using various technological items such as mp3 players, PDAs, and cell phones. Totally focused on the world of technology, the dancers are oblivious to the other dancers on stage. The dancers walk by one another without the slightest indication that they see one another. Like Edward Tenner in "Why Things Bite Back", the piece depicts the dancers' total involvement and dependency on technology. After several minutes, the metropolis fades out and the dancers emerge back on stage. Three of the dancers have a technological item and one dancer does not. The dancer that does not have a technological item tries to join the other three dancers, but gets rejected by each of them.

A trio of dancers is featured next. One dancer is stationed behind a screen with the other two dancers on the right and left of the screen. The dancer, representing technology, is behind the screen and a real time video filter is projected on her. The trio of dancers holds hands to perform a piece of choreography. This represents society's need for technology for the process of communication. The live dancer is seen on the apron of the stage as she is being filmed for the video filter projection. This placement of the dancer allows the audience to understand that the projection they are seeing are happening in real time and is not a pre-recorded film.

Modeling the Gertrude Stein Repertory Theater, the end of the piece features animation projected onto the dancers holding pieces of fabric. Moving with the fabric, the dancers use it to wrap it around themselves. The fabric represents the overpowering force of technology on society. Davis discussed this in detail in his book "Techgnosis". During the animation, boxes appear to break through the screen to

symbolize the various types of technology used on a daily basis. The animation becomes chaotic implying an overabundance of technology that society must deal with all at once. This chaos culminates in a Microsoft Windows styled critical system error or "Blue Screen of Death" and the dancers fall to the ground. This is intended to represent society's frustration over the overwhelming amount of technology.

Untangling themselves from the fabrics, the dancers slowly recover illustrating society's desire to free itself from daily the constraints of technology. Using a full-circle dramatic technique, the screen transitions back to the rolling clouds creating a literal and metaphorical loop. The conclusion of *Information Overload* symbolizes the relationship of humans and technology, which is constantly failing and being reborn to make another attempt at cohesion.

CHAPTER 4: EXECUTION

The original concept of *Information Overload* plans for the digital images to stretch the entire width of the stage. While testing in Mandell Theater, it was determined that rear screen projection could not be used for the performance. The dimensions of the stage are not deep enough for the image to stretch across the entire stage. Another problem occurred because the image itself was not bright enough when projected through the rear screen. In order to resolve this issue, a 1500 lumens projector is used at the back of the house to project onto the on stage video screen. Although the screen is not as wide as the stage, the mid-stage traveler can be slightly closed to create the illusion that it is.

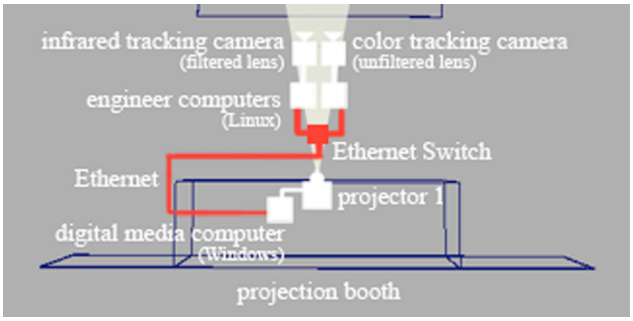

Figure 4A Visual Conception

4.1: Silhouetted dancers

The beginning of the performance features only one live dancer on stage. The other dancers, which appear as silhouettes, are previously recorded. The choreography is very playful and integrates a

focal prop, an umbrella, into the opening of the piece. The dancers move with an air of innocence, integrating them into the animation. The animation features falling letters, which simulate raindrops. To keep an air of innocence and simplicity, the choreography takes its inspiration from a simple eight-count movement phrase. From there, facing and footing are used to alter the movement.

Filming each dancer separately in Mandell Theater creates the silhouettes. Each dancer is instructed to wear all white and dancers with dark hair to wear an additional piece of fabric tied around their head. (see Figure 4.1A) The dancers are then filmed in front of a black curtain making it easier to key out later. Unfortunately, a white umbrella in a specific Totes style could be found, and a bright blue umbrella is used in its place. This particular Totes model is necessary because it is the easiest for the dancer to open and close rapidly. To create the illusion of the silhouettes morphing out of one another, the floor has to be measured and marked so that the dancers know exactly where to stand at certain points in the piece.

Figure 4.1A Dancer's costume for filming

After filming, the raw footage of the dancers is then brought into Autodesk Combustion. The goal is to key out the black curtain behind the dancers so all that remains are the individual dancers. The dancers are placed in front of the background cloud footage, taken from the Adobe Image Library. Due to the fact that each dancer was filmed separately, it is difficult to align the figures. In some cases a dancer appears too far to the right or left and may not be in time with their digital counterparts. This problem is rectified by carefully adjusting the individual dancer's footage. It is transformed, where needed, while the dancers moved across the stage to reduce the appearance of sliding. It can also be sped up or slowed down so that the dancers appear in time. A difference key is then applied to each individual dancer creating a silhouette. The silhouettes are then brought into Adobe Flash as individual frames and traced into native Flash vectors. (see Figure 4.1B) The vectors are programmed to

interact with the raining letters. Although it was difficult for the dancers to perform separately, it provides much more control in the choreography.

4.2: Metropolis

In the production of the metropolis, small flats are lowered allowing the dancers to interact with the set. The dancers appear to be walking in front of some buildings and behind others. This creates the effect that the two-dimensional animation is a three-dimensional environment. The set is constructed with two Broadway flats covered with medium weight NFR muslin and painted white. The flats are hung on different batons so they can fly out at different times. The dancers then emerge from the wings interacting with their cell phones, mp3 players, or PDAs. The choreography is pedestrian and emphasizes the daily routine played out by many people as they walk down the street.

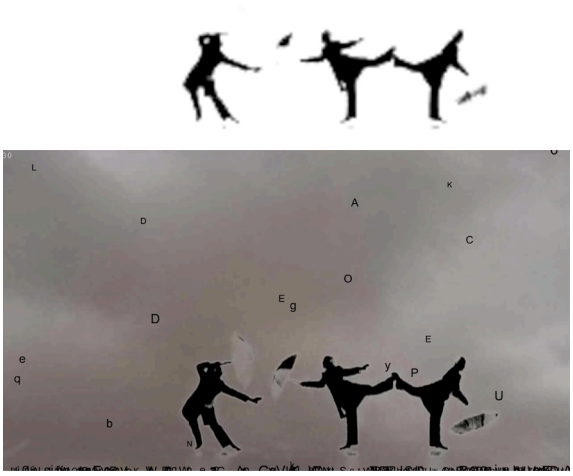

Figure 4.1B Stages of silhouetted dancers

The metropolis is animated and textured using Autodesk 3D Studio Max. In post-production, 2D fog is added using Combustion. This small detail makes the city appear more realistic. The metropolis alone is a static image however, by adding the fog, it creates a small amount of movement so that the audience does not loose interest. Originally, the city was designed to appear more two-dimensional. (see Figure 4.2A) However, after the creation of the pre-viz and feedback, it is determined that the city animation would be stronger if it incorporates a 3D camera pan.

To spur audience reaction, a ringing cell phone is inserted into the score as an experiment to see how the audience reacts. During a preview of the performance, viewers instinctively reached for their cell

phones thinking it was their own. This confirms society's reliance on technology to the point that a ring tone-- that may not be theirs-- causes an instinctive reaction.

Figure 4.2A 2D city vs. 3D city

4.3: Incorporating DICE

Next, the smaller flat and video screen flies out leaving the larger flat on stage. The movement begins when two dancers reach for each other but are unable to physically touch. As the choreography progresses, the dancer representing technology joins the other two dancers and the trio performs in unison. Once the dancer representing technology fades away, the two dancers perform in opposition.

The dancer representing technology is recorded during the performance using John Henry Thompson's DICE program. This program takes real-time video footage and allows a user to apply twenty-two unique filters. Throughout this scene four filters are applied in succession to the dancer's footage. (see Figure 4.3A) DICE requires each filter to be applied manually. In order for this to work for *Information Overload*, a stage crewmember must be stationed at the computer running DICE. Since the first projector

is positioned at the back of the house it causes the dancer to appear larger then life. Therefore, a second projector is used so the dancer appears closer to life size.

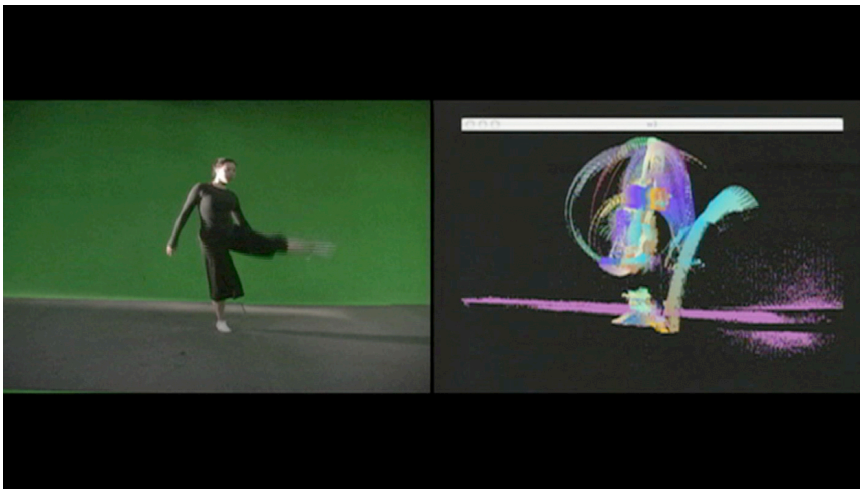

Figure 4.3A DICE filter

Originally one dancer was placed behind the flat and the other two on either side. After initial testing in Mandell Theater, it is determined that it would have a greater impact on the audience if they can see the live dancer and her projected image at the same time. Many options were explored to accomplish this goal. (see Figure 4.3B)

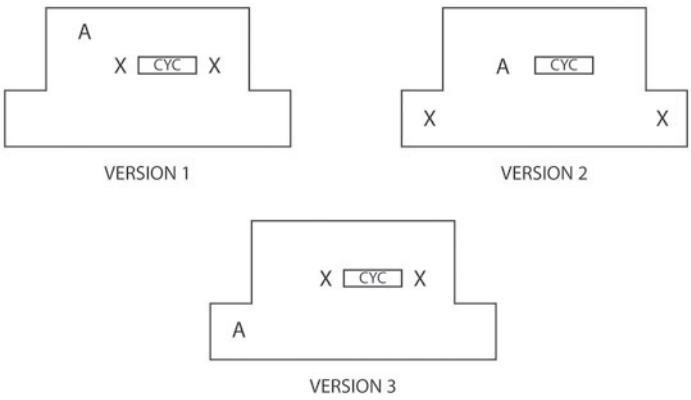

Figure 4.3B DICE options

The first option was to have the dancer representing technology (A) upstage, stage right and to have the other two dancers (X) downstage with the flat between them. The second option was to move the two dancers (X) to the apron and have the dancer representing technology (A) on stage next to the flat. The third option was the opposite of the second. This had the dancer representing technology (A) on the apron and the other two dancers (X) on stage with the flat between them.

It is decided that option three works best for two reasons. Firstly, the proscenium creates a natural division between the dancer representing technology and the live dancers. Secondly, the two dancers (X) can see the live dancer representing technology (A), but only acknowledge the technological version of her through their movement. This option allows the audience to see the two live dancers' (X) expressions. By incorporating this setup for the dancers, the three are no longer holding hands to represent the process of communication. Instead the dancers perform in succession so that the audience can clearly see them physically pass their movement to one another representing how technology sends and receives information.

4.4: Finale Animation

When the trio completes their choreography, the finale animation begins. It is first projected on the larger flat, which flies out while the video screen flies in. The animation appears very rigid and rectilinear; however, it becomes more curvilinear when it projects into organic forms. The final product is 3D modeled and animated in 3D Studio Max.

The animation went through many revisions; two versions were created. (see Figure 4.4A) The first version was the original idea with boxes of the projected texture moving towards the viewer. The second version was boxes pushing through a plane with an FFD applied to it. Version two caused the animation to look like the boxes were pushing behind the on stage video screen. After testing in Mandell Theater, it is concluded that while version two translates better on a computer screen, version one translates better on stage and integrates the dancers more within the animation.

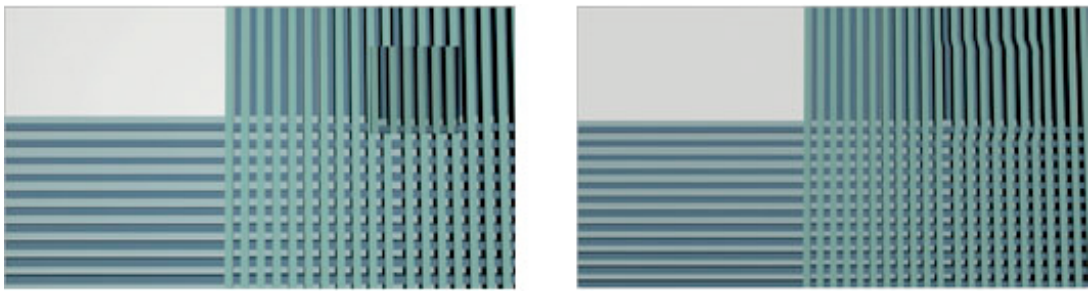

Figure 4.4A Version One animation vs. Version Two animation

The end of the animation was also revised several times. (see Figure 4.4B) It began with static images of boxes changing color. During this part the position of the boxes remained the same, but the color snapped to different hues. The shift between hues gradually became more rapid leading up to the many error messages and "Blue Screen of Death". After feedback, it is decided that this could be even more pronounced by adding motion to the color change. A rotating camera with motion blur was added making the scene even more chaotic. One last revision was required; a crescendo was added to the moving box's speed right before the animation "freezes" and the error messages build. These changes help to reinforce the concept and create a climax that is much bigger than the pre-viz depicted.

Figure 4.4B Stages of conclusion of finale animation

Experimentation with perspective is explored by creating different angles and shapes with the fabric. The choreography is not created in advance and the dancers are challenged to create their own movement with the fabric through structured improvisation. They explore many different possibilities; all attempting to trick the viewers' real sense of perspective as in Davis's aforementioned quote. Allowing the dancers this extended freedom gives them a voice in the production and choreography of the piece.

A decision was made as to whether the dancers should hold the fabric or incorporate it into their costume. Both ways were explored on the same choreographic phrase. By wearing the fabric, it appeared to be an extension of the dancers and did not further the concept. It is determined that by having the dancers hold the fabric, they are able to stretch and pull at it. This represents technology and symbolizes a struggle between the technology and the dancers.

CHAPTER 5: WORKING IN MULTI-DISCIPLINE ENVIORNMENTS

The complexity involved with this project spans many fields and requires significant collaboration from several programs at Drexel University including Performing Arts, Digital Media, Electrical and Computer Engineering, and Music Industry. In addition to the academic collaboration, several professionals are brought in to assist with the costume design, lighting design and technical assistance in the theatre. These academic and professional liaisons are experts in their field and provide support throughout the process. They are able to integrate aspects of the performance that would not have been possible without a profound knowledge of their respective fields; for example composing an original score and motion tracking a live dancer. By involving specialists from multiple disciplines everyone is able to learn from each other and gain knowledge of an unfamiliar field. We all work together as a combination of many disparate pieces creatively combined into a final performance.

5.1: Performing Arts Department

First and foremost, the Performing Arts Department is an instrumental part of the production of *Information Overload*. To locate the most skilled and artistically adept dancers, members of the Drexel University Dance Ensemble are notified about the production of *Information Overload* and invited to attend an audition. From the many dancers who auditioned, four dancers are chosen to perform in the piece based on their skill and artistic interpretation. In addition to having dancers, it is essential to have input from Dr. Miriam Giguere, Director of the Dance Program, offer her expertise designing the choreography.

Costume designer Heidi Barr is consulted regarding costumes for the piece. An initial meeting was scheduled to discuss preliminary ideas about the look of the costumes and fabrics that would be used. The piece requires the dancers' costumes be composed of white material. This way the animation's hue is

not distorted or hidden by the dancers. It is also necessary for the fabric the dancers hold to be elastic so it can be stretched and pulled easily.

Because each scene in the performance is so different, Heidi advises that a base costume be designed consisting of trousers and a shirt. Other elements such as jackets or fabric are added to the costume depending on the scene. While testing in Mandell Theater, a decision is reached that the fabric used for the end animation should be white and textured. Because there is no texture in the animation, the fabric creates its own texture. White was chosen so that the colors projected on the fabric match those on the screen. A lot of time is also spent constructing a vinyl raincoat that is used to track the dancer in the beginning of the piece. This jacket is constructed out of a shower curtain and is sewn with conductive thread, a thread that transmits energy.

Lighting designer, Krista Billings creates the final lighting design for the project, It is determined that the piece should mainly be lit with side and down lights so that the animations are not washed out.

Technical director of Mandell Theater, Mark Andrews, is an integral part of the running of the actual piece during performance. He is consulted as to how the engineers and stage crew will coordinate through the stage manager to operate the technology during the performance and creates alternative plans, in the case of technology failure during the performance. It is important to learn the technical terminology of the theater to be able to converse back and forth with both these professionals.

5.2: Music Industry

To produce the appropriate musical accompaniment, The Music Industry Program also makes a major contribution. One Music Industry student, Matthew Baker, composes an original score for the beginning of the piece. Music Industry adjunct faculty member, John Avarese composes the end. It is necessary to work closely with both composers so that the music follows the vision of the piece. An initial meeting was scheduled with John Avarese to define the music. During the meeting, the entire score was flushed out using key words to describe the objectives and tempo of the piece. From there, each composer presents a draft to formulate a basis for the choreography. As the choreography progresses, the score goes through several revisions until it matches.

5.3: Computer and Electrical Engineering

A team of senior engineering students working on their senior project under the direction of Dr. Youngmoo Kim is needed to design the complex technology interaction between the live dancer and digital letters [Congdon07]. The goal of their project is to track the dancer at approximately 30Hz aggregate rate and 5cm precision, be completely wirelessly operated, and integrate into a data collection system. Using tracking devices such as video, ultrasound, IEEE 802.11, and/or wireless sensor networks, they are able to capture the position of the live dancer on stage.

For the video tracking system, LED lights are incorporated into the dancer's costume to create different points along the body. These lights are invisible to the human eye, but by using an infrared filter, all visible light is blocked and the camera only sees the points on the dancer. The ultrasound system also needs to be incorporated into the dancer's costume. It is used to calculate the time of flight from the transmitter to the receiver. Different frequencies are used for different parts of the body and a rough figure of the dancer is shaped in the computer system. IEEE 802.11 or Drexel wireless is used to find the location of the dancer on stage; however, this system is only useful in providing the general position of a person. Additional access or directional antennas need to be added to improve the accuracy of the system. The wireless sensor network uses small battery-operated RF Motes. These motes are computers that contain different sensor packages, which enable the use of accelerometer inputs for motion tracking.

Throughout the lifespan of the project the engineering team narrows down the four aforementioned systems into one final video tracking system. This system is broken down into two methods of tracking, infrared LED and color histogram. In preliminary testing of the LED method, the camera is unable to observe individual LED light sources adequately. To improve the size of the points, the LEDs are arranged in clusters of six lights. The LED clusters are incorporated into a vinyl raincoat designed by Heidi Barr. (see Figure 5.3A) Using conductive thread, Heidi is able to sew the LED clusters onto the raincoat so there are no loose wires to get in the dancer's way. The clusters are powered with several nine-volt batteries and are hidden in a microphone pack. The clusters are positioned on the raincoat at ten key spots, two on the front of the coat, two on the back, two on each arm, and one on each side. The positions are chosen to represent the dancer's upper body from the widest number of angles. LED's are not incorporated into the dancer's lower body because there is a significant amount of floor movement. It is

Figure 5.3A LED raincoat designed by Heidi Barr

determined the risk of damage to the LEDs or the dancer is too great compared to the minimal data the lower body LEDs generate. The color tracking system is used to track the position of the umbrella. It is necessary to use color tracking because the umbrella could not be powered, as the LEDs require. Color tracking requires no power and therefore is ideal for smaller accessory props. Compared to the LED system the color tracking system requires much more precision. Before the piece is performed every night the color model used for the umbrella is initialized by manually sampling a specific area specified into the program's video feed. To ensure the best color tracking three different colored umbrellas are tested, magenta, lime green, and blue. After testing each color with the system it is determined that the blue umbrella tracked the best.

Two Firewire cameras utilizing IIDC, an uncompressed video transfer format, are used; one with an infrared filter to track the LEDs and one without any filters to color track the umbrella. These cameras are positioned behind the audience so they can capture the entire stage. Each camera is connected through Firewire to a dedicated tracking computer running Linux. The computers are running Open CV, a library of programming functions, mainly aimed at real-time computer vision [Hewwitt07]. It is used to Blob Track the LED clusters and the umbrella. Open CV is used to observe the video, track the white dots and umbrella, and assign each a unique ID and position. That position is sent through an Ethernet switch to the

display computer running the Flash animation in the projection booth. Using the Adobe Flash External API and a custom application coded in C#, the positions sent from Open CV every thirty frames per second, are used to create a rough figure of the dancer in Flash. The figure is created with ten blue circles, which represent the ten LED clusters on the dancer, while a dummy object represents the position of the umbrella held by the dancer. By setting the alpha in Flash to zero percent, the letters interact with the shapes, but are not visible to the audience. This creates the effect that the letters are bouncing off of the live dancer and her umbrella. (see Figure 5.3B)

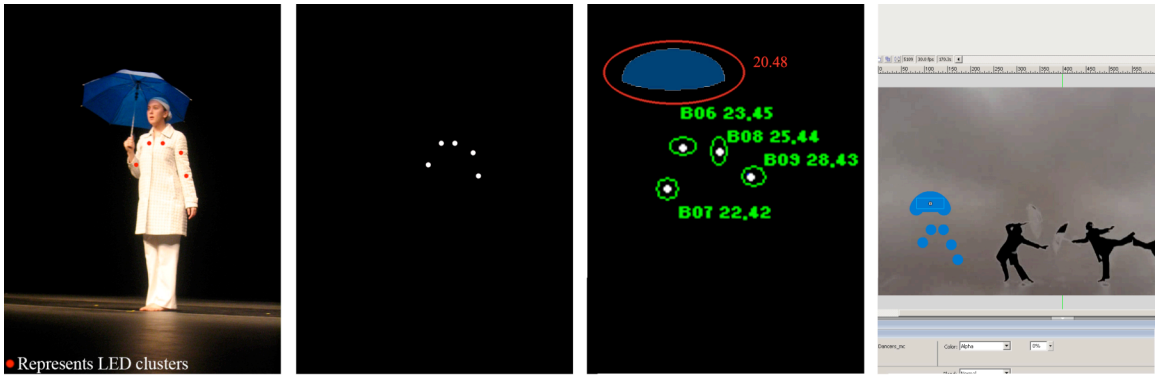

Figure 5.3B Motion tracking system

CHAPTER 6: OBSTACLES

During the process of creating *Information Overload*, many obstacles are overcome. To begin, the raining letters morph into the city animation and cannot be split between multiple media types. This means that the city animation must be included in the Flash animation despite the fact that Flash is not necessary for that part. Another constraint of using Flash video is only one video can be displayed at a time. Therefore, all video assets are imported into Flash as one composite video. The score during the DICE filters and finale QuickTime animation also are combined. While not inherently compatible, the two are merged into one QuickTime file to create a seamless transition. This leaves us with two media types, a Flash and QuickTime file, and no way to seamlessly transition between the two. To get around this limitation, the choreography between the three dancers with technological items and the one dancer without is developed to transition from the metropolis into the next scene. The dancers perform in silence with no

visuals, allowing the stage crew time to swap the Flash and QuickTime files. The choreography also helps to transition the movement from pedestrian back to modern.

Originally the silhouetted dancers were filmed in Drexel University's green screen room. (see Figure 6A) There are some constraints however because the green screen room was not deep enough for the camera to capture the entire stage. Therefore, the camera had to be positioned on an angle. Another constraint was that the size of the stage is not very wide. This led to the dancers having to perform small movements. Because of all the space constraints, the final version of the silhouetted dancers is filmed on the stage in Mandell Theater.

Figure 6A Filming in green screen room

After the footage is silhouetted, it needs to be brought into Flash so that it can be programmed to interact with the raining letters. Because the silhouettes were in High Definition format, it caused Flash to crash. To solve this problem, the High Definition silhouettes are incorporated into the composite video, which is much less resource intensive for Flash. Next, quarter sized silhouettes are brought into Flash and traced into native Flash vectors. (see Figure 6B) The vectors are scaled up and programmed to interact with the letters. Because the High Definition silhouettes are in the background video, the quarter-sized silhouettes can be made transparent causing it to appear as if the letters were interacting with the High Definition silhouettes. Silhouetting the footage could have been easier and cleaner looking if all dancers wore a piece of white fabric around their head and a white umbrella was used.

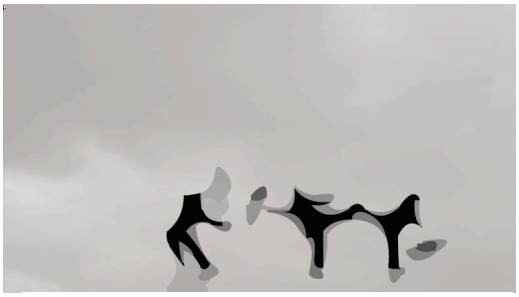

Figure 6B Traced bitmaps of silhouettes

One of the toughest obstacles of this project is working with the engineers. In case the engineers are not able to create a functional motion capture system in time for the performance, a back up plan is devised. Because the live dancer is filmed in Mandell Theater the same time as the silhouetted dancers, her footage can be treated the same way. This means that her footage can be brought into the Flash animation as a transparent object and programmed to interact with the falling letters. Therefore, the live dancer must perform exactly as she was filmed. To the audience it appears as if the live dancer is interacting with the letters when in reality it is her prerecorded footage.

There are a couple technological requirements for *Information Overload*. Firstly, the Flash animation has to run on a Windows based computer because the Flash Player is most optimized for the Windows OS. Secondly, DICE is only built to run on MacOS resulting in the need for two separate computers to be used during the performance. In addition, the engineers require two Linux computers in order for their tracking system to function. In the end, a total of four computers are loaned from the Digital Media program.

CHAPTER 7: CONCLUSION

The piece, *Information Overload*, examines how we relate to technology. Although most technological advances are developed to make life easier, it often becomes overwhelming. Despite the burden that technology may place on society, we are becoming overly dependent on it. Ironically, the very production of this piece mandates the integral use of the technology it attempted to explore. In order to create the complex visuals required by *Information Overload*, it is necessary to integrate several separate technologies. The vision of the piece demands this and would not have been possible without the tight integration. Furthermore, as the piece explains, we are eager to use bleeding edge technology despite its possible shortcomings.

While many dance pieces, such as those featured at SIGGRAPH 2006, have been created to showcase new technology, this too often results in the dance supporting the technology instead of the technology supporting the dance. If the dance and technology are not integrated the audience can have a hard time understanding the choreographers concept, thereby causing the piece to have less meaning. The concept of *Information Overload*, however, was developed first, and this thesis investigated which

technologies worked best within the concept. *Information Overload* is not about using technology it is about the use of technology.

During the process, there are moments when the technology used to create the piece would "crash." Programs would unexpectedly quit or fail to understand the demands placed on them. Several times these demands even resulted in unknown errors. As Davis discussed, this did not prevent us from using the technology; it only forces us to develop ways around the limitations. Despite some failures with the technology, there are many successes. We are able to accomplish things that stretched the boundaries of the technology all the while incorporating it into a live performance.

Many conscious decisions were made to help achieve this balance between the performance and the technology, such as the balance between the projected visual elements and the live performers. The author drew inspiration from perceived failings (with respect to what *Information Overload* is trying to achieve) in other pieces. For example, Olive Prince's *Spare Change* and ASU's *Lucidity* both projected visuals above dancers; the dancers appeared to be separate from the visuals and created a disconnect for the audience. It made it difficult to focus on the dance and the digital media at the same time. The audience would find themselves watching either the dance or the digital media but not both. This results in a typical audience member missing half the performance, as they are busy refocusing their attention throughout the piece. In contrast, the use of digital media is balanced throughout *Information Overload*. The dance and digital media are of equal importance and do not overpower each other. During the finale animation, the tight integration of the dance and digital media makes it easy to experience both simultaneously. The dancers themselves are used as a projection surface and become a physical part of the animation. Their body movement draws from the animation thus making them an extension of the animation. If one aspect, either the dance or the digital media, is more important, the other is downplayed so as to remove the possibility of splitting the audience's attention. In the beginning of the piece the quote rains into the scene and the dancer leaves the stage; this allows the audience to focus their attention solely on reading the quote. Similarly, at the end of the piece, the "Blue Screen of Death" begins with all the dancers lying on the ground. After the audience has enough time to process the screen, it repeats and the dancers begin to untangle themselves from their fabric. The repetition of the visuals allows the audience to focus their full attention on the dancers. By creating a balance between the dance and digital media, *Information Overload*

was able to direct the viewers' eye in a different way than *Spare Change* or *Lucidity* were able to do. It is the author's view that unless carefully designed and balanced, technology can easily "overload" the performance.

Information Overload premiered in May 2007 and was well received. The audience reacted to the piece much like the concept had hoped for. The audience's response of wonderment during the interactive "rain" scene demonstrates our acceptance without questioning of the magic of technology. Anecdotal audience responses indicate the audience experienced a personal connection with the piece. They related to walking down the street talking on a cell phone as well as experiencing their computer "crash". These responses mirror the author's intent, and demonstrate that the integration of live dance and digital media can create a performance piece that conveys a message about technology's impact on our lives that neither dance nor digital media could alone achieve.

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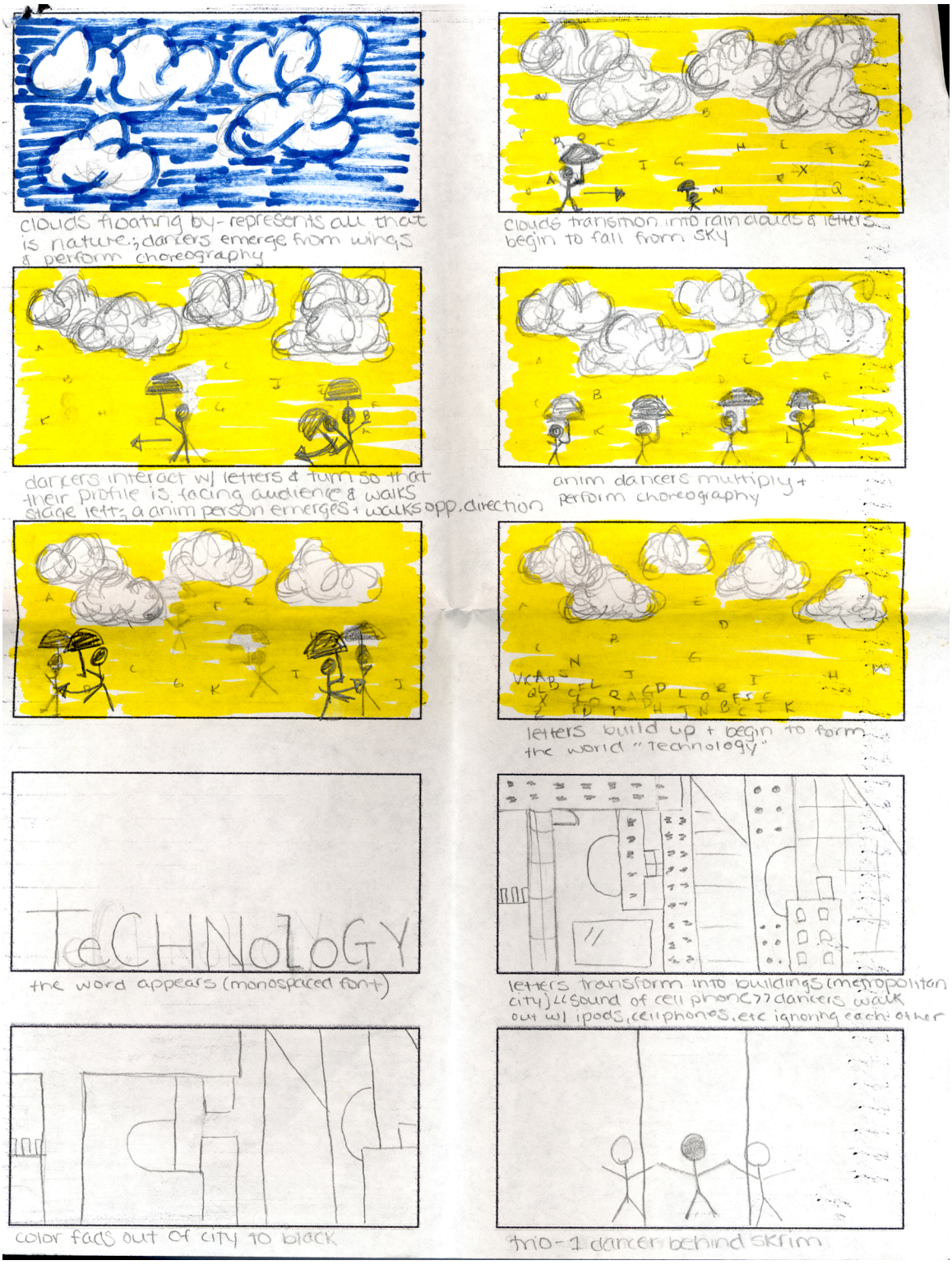
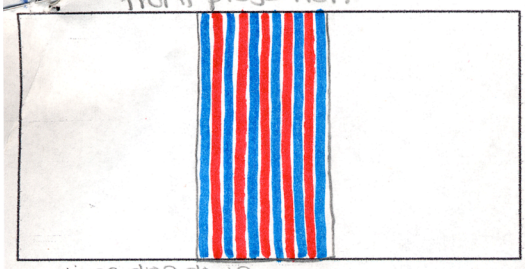
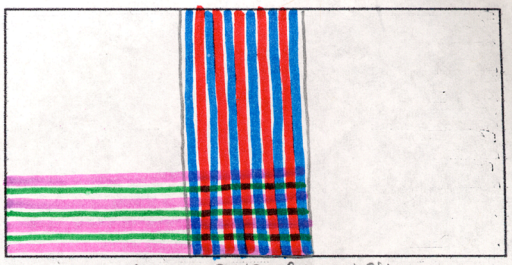
Appendix A: Storyboards



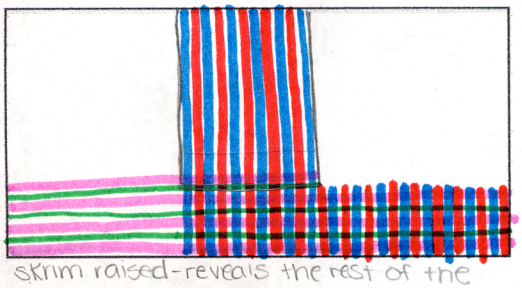
front projection—



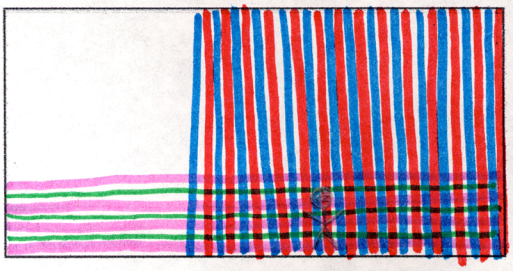
lines drop down

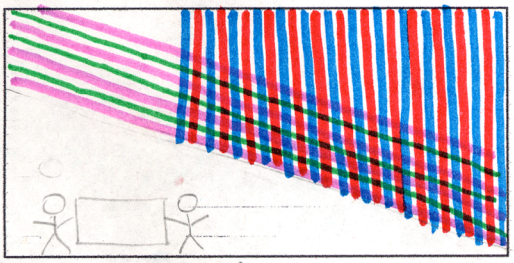


horizontal lines enter from left

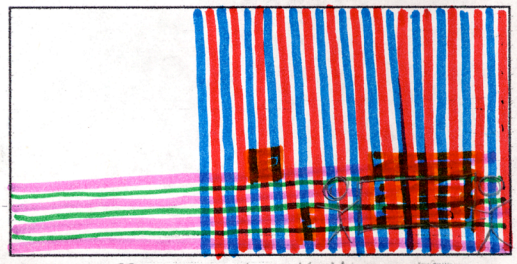


skrim raised-reveals the rest of the lines



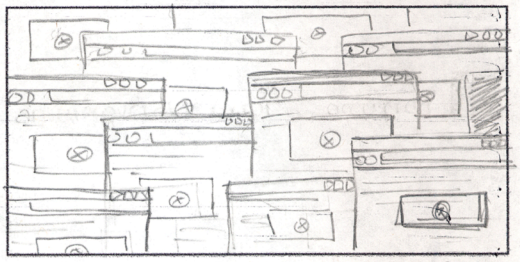


plays w/ distortion

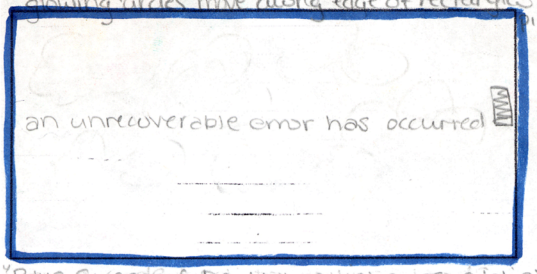


squares try to break through (lines look like fabric)

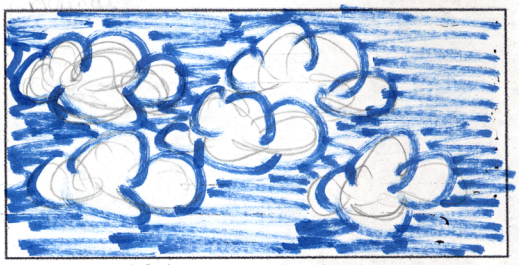
big rectangle breaks through & rectangles multiply & change colors faster & faster growing circles move along edge of rectangles (like pinballs)



rectangles change to computer error windows



"Blue Screen of Death" - giant cursor blinks

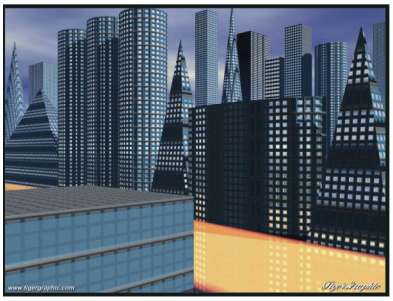


slow fade back to rolling clouds

Appendix B: Concept Art

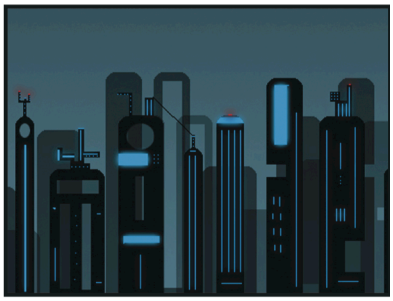
Concept Art for Metropolitan City

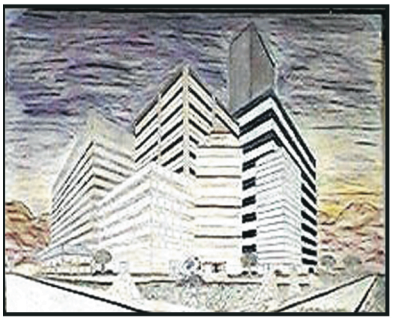
by Lauren Mandilian



When I first envisioned my city, I pictured small lit up windows that would define the shape of the building more so then the texture. This image conveys this idea exactly. I also like the color in this image.

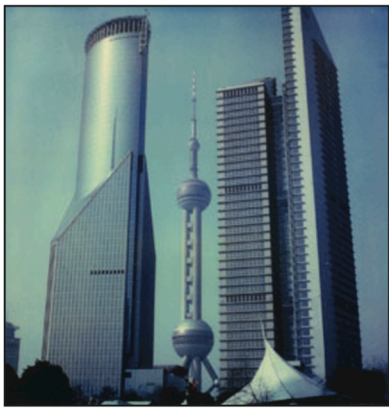
The city will be constructed from the word "TECHNOLOGY" Letters like "O" and "G" will create openings or holes in some of the buildings (similar to this image).





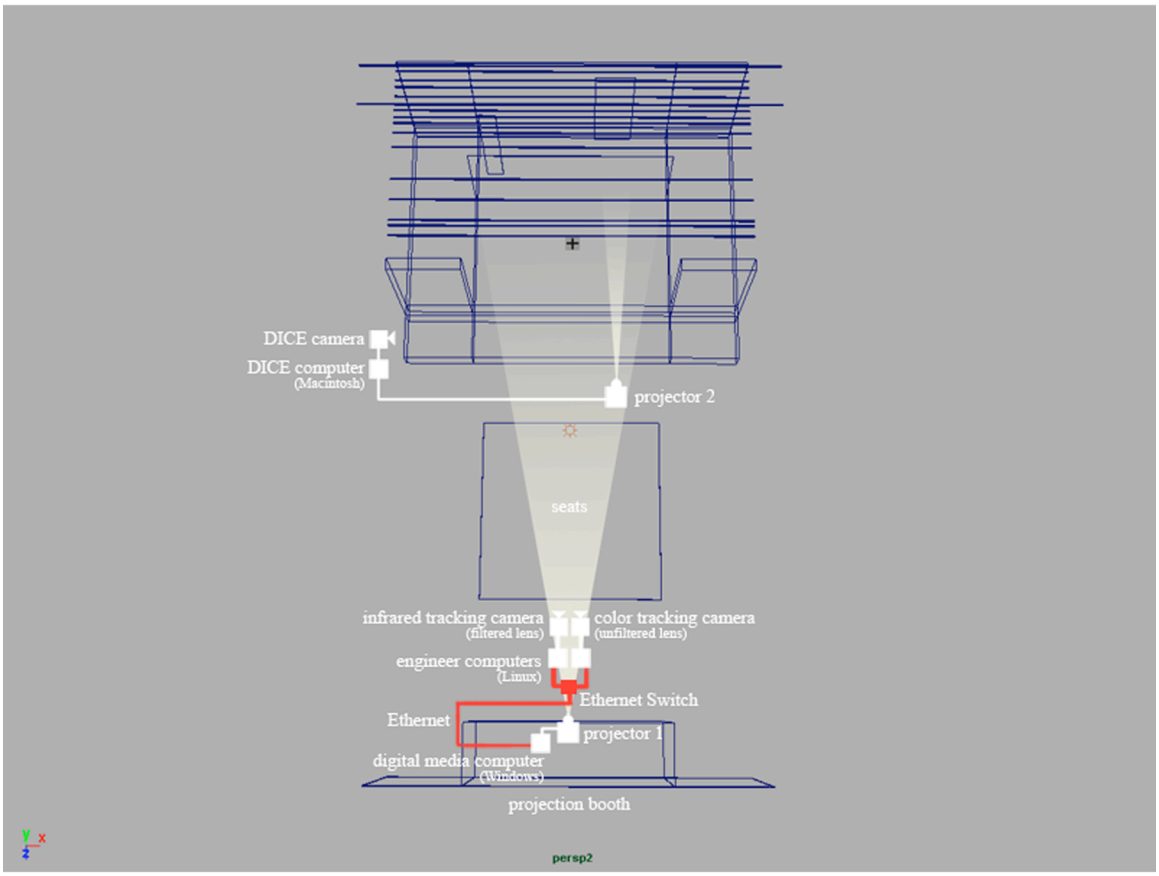
Some sections of the city will also be very angular because it will be contructed from letters like "N" or "Y". I like the stripped lines on these buildings and the perspective of the image. I will try to use these two techniques to make the buildings apppear even more angular.

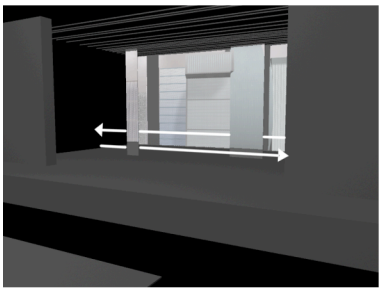
When I picture a metropolitan city, I picture buildings made of glass. I would like to have some of my buildings have this same look as the buildings in this image.



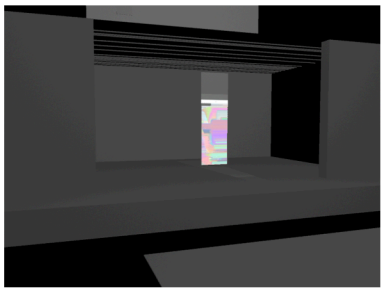
Appendix C: Visual Conception

Visual Conception





Metropolis



DICE Filter

Animation Projected on Fabric